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for close examination by a small bore rifle. It was then found that the attack by the birds was even more serious than it appeared, for they had punctured the skin in places along the back and drawn blood with their sharp bills, and in time, perhaps, might have killed the rodent.

The California Woodpecker is not exceptional in its hatred of its traditional enemy, the squirrel, and Merriam, as above cited, was witness to attacks by the Red-head on both the grey and the black squirrel. Evidently the woodpeckers of the Adirondack region look upon the crop of beech nuts as peculiarly their own, and promptly resent on the part of outsiders any attempt to share in it. Not woodpeckers alone are a bit hazy in respect to property rights, and the enforcement of conflicting views on the subject often leads humans into acts that bear a curious analogy to the ones above noted.

Take him all in all, the California Woodpecker presents a rarely inviting subject for study, especially with reference to the genesis and significance of its food storing habits. Since California at the present time is exceptionally fortunate in the number and activity of its bird students it is to be hoped that among them are those who will take up the subject systematically, and endeavor to unravel the many puzzling questions that touch upon the life history of this beautiful and interesting species.

Washington, D. C., May 15, 1921.

THE STORAGE OF ALMONDS BY THE CALIFORNIA WOODPECKER

By CLAUDE GIGNOUX

WITH ONE PHOTO

ON Saturday, March 26, 1921, I spent about two hours inspecting the larger trees and the buildings on the ranch of Mrs. Nora Thresher, in Butte County, California, to obtain information in regard to the storing of almonds by the California Woodpecker (*Melanerpes formicivorus bairdi*). The three places at which we found almonds stored are close together near the ranch house. The locality is one quarter of a mile west of the Feather River, five miles northeast of Liveoak, four miles southeast of Gridley and one and a quarter miles east of the Manzanita School, and is in Township 17 N., Range 3 E., M. D. B. and M. The country for several miles in every direction is practically level and very fertile and the mature native trees left standing are magnificent individual specimens. There are many fruit orchards in the section from Marysville to Gridley, and almonds are extensively grown farther north, around Durham. On the Thresher ranch there is a very heavy growth of trees and brush along the Feather River and this heavy growth extends a considerable distance in both directions along the river beyond the boundaries of the ranch.

Mr. Gerald J. Chalmers, whose ranch adjoins the Thresher ranch, had told me that he had found almonds stored in the bark of an oak tree, on the Thresher ranch, which had been cut down about the middle of February, 1921,

a slab of which he kept and handed to me on the day of our hunt for stored almonds. This slab is 16 inches long, 5 inches wide at one end and 7 inches wide at the other. It has been delivered to the Museum of Vertebrate Zoology in Berkeley. The photograph of a portion of this piece gives a clear idea of just how the original appears (see fig. 23). The tree from which it was taken had been cut down, sawed into firewood lengths, and split up by a machine. The pieces were then thrown into a pile and ranked in tiers. In this process each piece of wood had been subjected to a great deal of rough handling and it is surprising that any of the nuts remained in the bark.

We found almonds stored at three places: (1) In the bark of the oak tree mentioned; (2) in the side of a rather old barn; and (3) in the bark of a

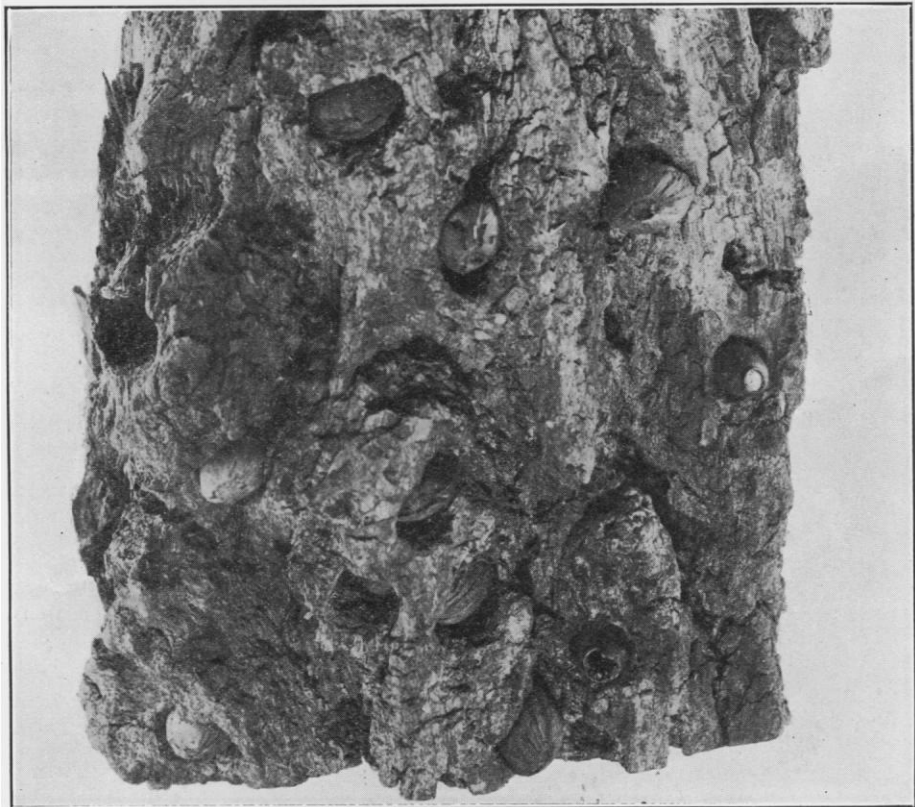


Fig. 23. PORTION OF SLAB FROM VALLEY OAK SHOWING ALMONDS AND ACORNS IN PITS, THE WORK OF CALIFORNIA WOODPECKERS IN BUTTE COUNTY, CALIFORNIA.

living, standing oak. There were within an area of perhaps ten or a dozen acres about fifteen large standing oaks, five or six recently felled oaks and several farm buildings, some of which were quite old. A crew of men was cutting up one of the trees and ranking the wood up in tiers.

At point number 1 the tree had been cut down close to the ground and completely cut up in firewood lengths and these ranked in tiers. We found several pieces, in the bark of which acorns and almonds had been stored or in which holes had been drilled for acorns or almonds. The slab in the photo-

graph is a part of this tree. Mr. Chalmers said that this tree was almost wholly dead when felled. The slab shown in the photograph is dried and worm-eaten. Nothing was learned as to the part of the tree from which the slab came but it was evidently from the trunk or a large limb. Mr. Chalmers thought the tree was a Valley Oak (*Quercus lobata*), but this is not intended as a definite identification. From the number of drilled holes with or without acorns or almonds in them it was evident that the bark of the tree had been extensively used as a storage place both for acorns and almonds. There were several large decayed holes in the tree and in these we found both acorns and almonds, but they were not fitted into specially drilled cavities. When the tree was felled Mr. Chalmers was present and he told me that a pair of owls flew out of one of these large holes after the tree had fallen to the ground. We learned nothing as to the means by which the acorns and almonds were placed in these decayed cavities. The only opened almonds we found were from these decayed places. We thought that these almonds had not been opened by woodpeckers.

At point number 2 holes had been drilled in the boards on the west side of a large barn and many acorns and a few almonds stored in them. All the holes were above the level of the top of the main door. All the drilling had been done in boards resting against the larger timbers of the frame. There were drillings in the ends of boards where the boards rested against a horizontal plate over the doorway and pretty much across the front of the barn along this timber and up along the upright timbers as well. No holes were drilled except in the outer surface of the boards where the boards rested against the frame. We thought that the holes, or most of them, went through the boards and into the timbers of the frame.

At point number 3 the bark of the whole trunk above a point about twelve feet from the ground and most of the bark of the larger limbs had been drilled and hundreds if not thousands of acorns and almonds stored. Mr. Chalmers expressed the appearance of the bark very well when he said, "There must be a sack of almonds up there". This tree was a living oak and we thought it was a Valley Oak. There were more dead limbs on this tree than we found in other similar trees in the vicinity. The tree is very large and must be about five feet through the trunk one foot above the ground. In some of the limbs were holes that we thought were the entrances to the nests of woodpeckers but we did not see any birds enter or leave them. Acorns and almonds were stored in all sides of the tree and in all sides of the larger limbs we could see from the ground. We did not go up into the tree to see if nuts had been stored in the bark on the upper sides of the limbs.

This work is assumed to have been done by the California Woodpecker, which is a common bird in that country. The acorns were stored in the manner known to be employed by this bird and there seemed no reason to deny it credit for the almonds also. We did not, however, see them doing anything in connection with the storage places we found. Nearly all the acorns and almonds were inserted in the drilled holes point first but some were fitted in natural crevices sidewise. All acorns had been freed from their cups before being stored and all the almonds were without hulls. We thought that this tree contained about an equal number of almonds and acorns. Every nut was fitted in its place too snugly to be easily removed. In most cases the base of

the nut was flush with the surface of the bark or even a little countersunk. Some few were inserted so as to protrude more or less. Some were inserted about a quarter of the length of the nut but very tightly at that. Here and there was a nut too small to fill the hole made for it, but the orifice of the hole was too small to permit the nut to be easily taken out. There were many empty holes and some holes only partly drilled. Many of the acorns had been opened and the shells left in the drilled cavities. We did not find any opened almonds (except in the one instance noted) although many empty holes were found where almonds had been or which had been drilled for almonds. The difference between holes drilled for almonds and those drilled for acorns is very marked. We could not detect any disposition to drill the holes so that they would not hold water. All were about horizontal. Several almonds in the drilled holes looked as if an effort had been made to open them. The opening of an almond presents no difficulty to a bird that can cut a hole in dried oak.

Of course, acorns must be abundant all about. Mr. Chalmers said there were two almond trees on the Thresher ranch and I was told that until this spring there had been an almond orchard less than a half mile to the north.

Oak trees and California Woodpeckers have existed together for so long a time that they may be considered coetaneous. But almonds are not indigenous in California. The habit of storing acorns may have developed very gradually, but to whatever extent this bird has acquired a habit of storing almonds the development must have been of recent origin. The subject suggests many interesting possibilities and theories but I do not feel competent to go into that phase of the matter.

A gentleman living at Liveoak told me he had seen almonds stored in electric light or telephone poles at Pennington, eight miles east of Liveoak, and that he had heard of walnuts being stored in the same manner, but he could not give any details about the walnuts.

Berkeley, California, March 31, 1921.

THE FLOCK BEHAVIOR OF THE COAST BUSH-TIT

By R. C. MILLER

WITH MAP

THE STUDY of birds has had a tendency in the past to be extensive rather than intensive. The ornithologist has been engaged with the problems of distribution and speciation, of migratory instincts and migration routes, of coloration and adaptation, of food and economic importance, all of which, while thoroughly justifiable, have involved a generalized consideration of a large number of species. It has seemed to the writer that much is to be gained from a careful study of a single species, or even, as in the case of this paper, of a single aspect of the life history and relations of one species.